

L Number	Hits	Search Text	DB	Time stamp
1	3632	716/\$.ccls.	USPAT	2003/02/04 13:51
2	500	((716/12) or (716/13) or (716/14)).CCLS.	USPAT	2003/02/04 13:54
3	10	((((716/12) or (716/13) or (716/14)).CCLS.) and linear near3 (program\$4 or problem)	USPAT	2003/02/04 14:02
4	9765	net and partition\$3 snf rout\$3 and linear near2 program\$4 and edge	USPAT	2003/02/04 14:05
5	461	716/\$.ccls. and (net and partition\$3 snf rout\$3 and linear near2 program\$4 and edge)	USPAT	2003/02/04 14:05
6	92	((((716/12) or (716/13) or (716/14)).CCLS.) and (net and partition\$3 snf rout\$3 and linear near2 program\$4 and edge)	USPAT	2003/02/04 14:05
7	90	(((((716/12) or (716/13) or (716/14)).CCLS.) and (net and partition\$3 snf rout\$3 and linear near2 program\$4 and edge)) not (((716/12) or (716/13) or (716/14)).CCLS.) and linear near3 (program\$4 or problem))	USPAT	2003/02/04 14:41
8	326	(716/12).CCLS.	USPAT	2003/02/04 14:41
9	2	((716/12).CCLS.) and (partition\$3 with region)	USPAT	2003/02/04 14:42
10	4	((716/12).CCLS.) and (linear near3 (program\$3 or problem))	USPAT	2003/02/04 14:44
11	2	partition\$3 same net same edge same rout\$3	USPAT	2003/02/04 14:47

IEEE HOME | SEARCH IEEE | SHOP | WEB ACCOUNT | CONTACT IEEE

Membership Publications/Services Standards Conferences Careers/Jobs

IEEE Xplore[®]
RELEASE 1.4Welcome
United States Patent and Trademark OfficeHelp FAQ Terms IEEE Peer Quick Links
Review

>> Search

Welcome to IEEE Xplore[®][SEARCH RESULTS](#)[\[PDF Full-Text \(364 KB\)\]](#)[PREVIOUS](#)[DOWNLOAD CITATION](#)

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

[Tables of Contents](#)

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

[Search](#)

- ☐ By Author
- ☐ Basic
- ☐ Advanced

[Member Services](#)

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

[Print Format](#)

Four-bend top-down global routing

Cho, J.D. Sarrafzadeh, M.Sch. of Electr. & Comput. Eng., Sungkyunkwan Univ., Suwon;This paper appears in: **Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on**On page(s): 793-802Volume: 17, Sep 1998ISSN: 0278-0070References Cited: 31CODEN: ITCSDIINSPEC Accession Number: 6041727

Abstract:

We propose a new global net distribution approach for high-performance $m \times m$ two-dimensional arrays of very large scale integration and multichip-modules. The objective is to route n nets with minimum density of global cells, using a "number of bends. There are a number of applications where it is necessary to limit the number of bends on each wire. For example, it is desirable to limit the number of bends on each microstrip (transmission) line, for mismatch of line impedance can cause reflections from the junction points such as bends and vias. Furthermore, for high-performance routing, intersections of wires cause the use of more vias, which in turn require the use of more routing resources (because of the larger via pitch). This is the first paper that addresses a graph-theoretic framework to solve the bend-constrained global routing problem in two-dimensional arrays. In this paper, at each level of an underlying quad-tree, we present a new four-bend routing algorithm by decomposing the original problem at level i into subproblems that can be solved exactly based on a two-stage approach of smaller-sized linear program followed by min-cost flow networks. The overall (entire level of the four-way partition hierarchy) constraint and variable size for first stage is $O(md_o)$, while the overall run time for the second stage is $O(n^3 \log n^2)$. The time complexity of such a hierarchical approach is one order of magnitude less than one of constructing a global routing using the min-cost-flow-based flow design approach. Last, we present an extension that permits a limited degree of control over the number of bends. The proposed algorithm can also be used for estimating the wireability in the early design planning stage for high-level synthesis. Experimental results showed the effectiveness of the proposed algorithm.

Index Terms:

VLSI circuit layout CAD computational complexity flow graphs high level synthesis integrated circuit layout linear programming logic partitioning network routing wiring

Documents that cite this document

[IEEE HOME](#) | [SEARCH IEEE](#) | [SHOP](#) | [WEB ACCOUNT](#) | [CONTACT IEEE](#)[Membership](#) [Publications/Services](#) [Standards](#) [Conferences](#) [Careers/Jobs](#)**IEEE Xplore**
RELEASE 1.4Welcome
United States Patent and Trademark Office[Help](#) [FAQ](#) [Terms](#) [IEEE Peer Review](#) [Quick Links](#)

>> Search

Welcome to IEEE Xplore®

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

Tables of Contents

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

Search

- ☐ By Author
- ☐ Basic
- ☐ Advanced

Member Services

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

 Print FormatYour search matched **2** of **916175** documents.

A maximum of **2** results are displayed, **25** to a page, sorted by **Relevance** in **descending** order.
You may refine your search by editing the current search expression or entering a new one the text
Then click **Search Again**.

wiring <and> problem <and> linear <and> subproblem

Search Again

Results:

Journal or Magazine = **JNL** Conference = **CNF** Standard = **STD****1 Linear complexity algorithms for hierarchical routing***Hachtel, G.D.; Morrison, C.R.;*

Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on
Volume: 8 Issue: 1, Jan 1989
Page(s): 64 -80

[\[Abstract\]](#) [\[PDF Full-Text \(1500 KB\)\]](#) **IEEE JRN****2 Four-bend top-down global routing***Cho, J.D.; Sarrafzadeh, M.;*

Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on
Volume: 17 Issue: 9, Sep 1998
Page(s): 793 -802

[\[Abstract\]](#) [\[PDF Full-Text \(364 KB\)\]](#) **IEEE JRN**

[Home](#) | [Log-out](#) | [Journals](#) | [Conference Proceedings](#) | [Standards](#) | [Search by Author](#) | [Basic Search](#) | [Advanced Search](#)
[Join IEEE](#) | [Web Account](#) | [New this week](#) | [OPAC Linking Information](#) | [Your Feedback](#) | [Technical Support](#) | [Email Alerting](#)
[No Robots Please](#) | [Release Notes](#) | [IEEE Online Publications](#) | [Help](#) | [FAQ](#) | [Terms](#) | [Back to Top](#)

Copyright © 2002 IEEE — All rights reserved

IEEE HOME | SEARCH IEEE | SHOP | WEB ACCOUNT | CONTACT IEEE

Membership Publications/Services Standards Conferences Careers/Jobs

IEEE Xplore
RELEASE 1.4Welcome
United States Patent and Trademark Office[Help](#) [FAQ](#) [Terms](#) [IEEE Peer Review](#)[Quick Links](#)» [Search](#)

Welcome to IEEE Xplore®

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

Tables of Contents

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

Search

- ☐ By Author
- ☐ Basic
- ☐ Advanced

Member Services

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

 Print FormatYour search matched **16** of **916175** documents.

A maximum of **16** results are displayed, **25** to a page, sorted by **Relevance** in **descending** order.
You may refine your search by editing the current search expression or entering a new one the text
Then click **Search Again**.

linear <and> problem <and> route <and> net

[Search Again](#)**Results:**Journal or Magazine = **JNL** Conference = **CNF** Standard = **STD****1 Cell height reduction by routing over-the-cells***How-Rern Lin; Hourng-Wern Perng; Yu-Chin Hsu;*

Circuits and Systems, 1992. ISCAS '92. Proceedings., 1992 IEEE International Symposium on , Volume: 5 , 10-13 May 1992

Page(s): 2244 -2247 vol.5

[\[Abstract\]](#) [\[PDF Full-Text \(348 KB\)\]](#) **IEEE CNF****2 An efficient algorithm for the net matching problem***Carragher, R.J.; Cheng, C.-K.; Fujita, M.;*

Computer-Aided Design, 1993. ICCAD-93. Digest of Technical Papers., 1993 IEEE International Conference on , 7-11 Nov 1993

Page(s): 640 -644

[\[Abstract\]](#) [\[PDF Full-Text \(364 KB\)\]](#) **IEEE CNF****3 A new global router based on a flow model and linear assignment***Meixner, G.; Lauther, U.;*

Computer-Aided Design, 1990. ICCAD-90. Digest of Technical Papers., 1990 IEEE International Conference on , 11-15 Nov 1990

Page(s): 44 -47

[\[Abstract\]](#) [\[PDF Full-Text \(372 KB\)\]](#) **IEEE CNF****4 Hybrid leader-follower and fuzzy-Petri-net traffic rate control and supervisi n in network systems***Dimirovski, G.M.; Yuanwei Jing; Siying Zhang;*

Telecommunications in Modern Satellite, Cable and Broadcasting Service, 2001.